

Synthesis and characterization of manganese ferrite nanoparticles by thermal treatment method.

ABSTRACT

Cubic structured manganese ferrite nanoparticles were synthesized by a thermal treatment method followed by calcination at various temperatures from 723 to 873 K. In this investigation, we used polyvinyl pyrrolidone (PVP) as a capping agent to control the agglomeration of the nanoparticles. The characterization studies were conducted by X-ray diffraction (XRD) and transmission electron microscopy (TEM). The average particle sizes of manganese ferrite nanoparticles were determined by TEM, which increased with the calcination temperature from 12 to 22 nm and they had good agreement with XRD results. Fourier transform infrared spectroscopy confirmed the presence of metal oxide bands at all temperatures and the absence of organic bands at 873 K. Magnetic properties were demonstrated by a vibrating sample magnetometer, which showed a super-paramagnetic behavior for all samples and also saturation magnetization (M_s) increases from 3.06 to 15.78 emu/g by increasing the calcination temperature. The magnetic properties were also confirmed by the use of electron paramagnetic resonance spectroscopy, which revealed the existence of unpaired electrons and also measured peak-to-peak line width, resonant magnetic field and the g-factor.

Keyword: Manganese ferrite; Nanoparticles; Thermal treatment; Magnetic property.